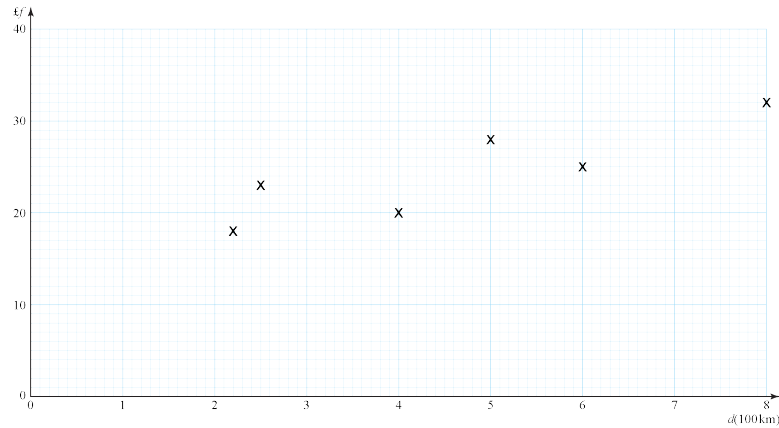


AS Practice Paper H (Statistics & Mechanics) mark scheme

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
1a	Quota.	<b>B1</b>	1.2	3rd Understand quota and opportunity sampling.
		<b>(1)</b>		
1b	Advantages – two from: <ul style="list-style-type: none"> <li>• easy to get sample size</li> <li>• inexpensive</li> <li>• fast</li> <li>• can be stratified if required.</li> </ul>	<b>B1</b> <b>B1</b>	2.4 2.4	5th Select and critique a sampling technique in a given context.
	Disadvantages – one from: <ul style="list-style-type: none"> <li>• not random</li> <li>• could be biased.</li> </ul>	<b>B1</b>	2.4	
			<b>(3)</b>	
1c	Allocate each of the males a number from 1 to 300	<b>B1</b>	3.1b	3rd Understand and carry out simple random sampling.
	Use calculator or number generator to generate 50 different random numbers from 1 to 300 inclusive.	<b>B1</b>	1.1b	
	Select males corresponding to those numbers.	<b>B1</b>	1.1b	
		<b>(3)</b>		
1d	$300 \div 50 = 6$	<b>B1</b>	3.1b	3rd Understand and carry out simple random sampling.
	Use a random number generator to select the first name (or one of the first 6 names on the list) as a starting point and then select every 6th name thereafter to get 50 names.	<b>B1</b>	1.1b	
		<b>(2)</b>		
				<b>(9 marks)</b>
<b>Notes</b>				

AS Practice Paper H (Statistics & Mechanics) mark scheme

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
2a	All points correctly plotted. 	<b>B2</b>	1.1b	2nd Draw and interpret scatter diagrams for bivariate data.
		<b>(2)</b>		
2b	The <b>points</b> lie reasonably close to a <b>straight line</b> (o.e.).	<b>B1</b>	2.4	2nd Draw and interpret scatter diagrams for bivariate data.
		<b>(1)</b>		
2c	<i>f</i>	<b>B1</b>	1.2	2nd Know and understand the language of correlation and regression.
		<b>(1)</b>		
2d	Line of best fit plotted for at least $2.2 \leq x \leq 8$ with <i>D</i> and <i>F</i> above and <i>B</i> and <i>C</i> below.	<b>M1</b>	1.1a	4th Make predictions using the regression line within the range of the data.
	26 to 31 inclusive (must be correctly read from $x = 7$ from the line of best fit).	<b>A1</b>	1.1b	
		<b>(2)</b>		

**AS Practice Paper H (Statistics & Mechanics) mark scheme**

<b>2e</b>	It is reliable because it is interpolation (700 km is within the range of values collected).	<b>B1</b>	2.4	4th Understand the concepts of interpolation and extrapolation.
		<b>(1)</b>		
<b>2f</b>	No, it is not sensible since this would be extrapolation (as 180 km is outside the range of distances collected).	<b>B1</b>	2.4	4th Understand the concepts of interpolation and extrapolation.
		<b>(1)</b>		

**(8 marks)**

**Notes**

**2a**

First B1 for at least 4 points correct, second B1 for all points correct.

**2b**

Do not accept ‘The points lie reasonably close to a line’. Linear or straight need to be noted.

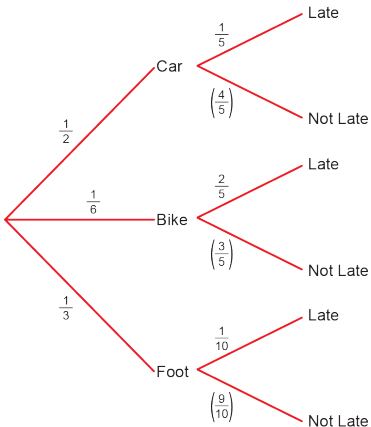
**2e**

Also allow ‘It is reliable because the points lie reasonably close to a straight line’.

**2f**

Allow the answer ‘It is sensible since even though it is extrapolation it is not by much’ provided that the answer contains both ideas (i.e. it IS extrapolation but by a small amount compared to the given range of data).

AS Practice Paper H (Statistics & Mechanics) mark scheme

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
3a	 <p>Correct tree structure. All labels correct. All probabilities correct.</p>	<p><b>B1</b> <b>B1</b> <b>B1</b></p>	<p>3.1a 1.1b 1.1b</p>	<p>3rd Draw and use tree diagrams with three branches and/or three levels.</p>
3bi	$\frac{1}{3} \times \frac{1}{10} = \frac{1}{30}$ or equivalent.	<p><b>M1</b> <b>A1</b></p>	<p>3.4 1.1b</p>	<p>3rd Draw and use tree diagrams with three branches and/or three levels.</p>
3bii	<p>Car NL + Bike NL + Foot NL</p> $= \left(\frac{1}{2} \times \frac{4}{5}\right) + \left(\frac{1}{6} \times \frac{3}{5}\right) + \left(\frac{1}{3} \times \frac{9}{10}\right)$ $= \frac{4}{5} \text{ or equivalent.}$	<p><b>M1</b> <b>A1</b></p>	<p>3.4 1.1b</p>	<p>3rd Draw and use tree diagrams with three branches and/or three levels.</p>
<b>(7 marks)</b>				
<p><b>Notes</b></p> <p><b>3bii</b> ft from their tree diagram. Allow one error for M1.</p> <p>Can also be found from <math>1 - \left( \left( \frac{1}{2} \times \frac{1}{5} \right) + \left( \frac{1}{6} \times \frac{2}{5} \right) + \left( \frac{1}{3} \times \frac{1}{10} \right) \right)</math></p>				

AS Practice Paper H (Statistics & Mechanics) mark scheme

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
4a	Two from: <ul style="list-style-type: none"> <li>Each bolt is either faulty or not faulty.</li> <li>The probability of a bolt being faulty (or not) may be assumed constant.</li> <li>Whether one bolt is faulty (or not) may be assumed to be independent (or does not affect the probability of) whether another bolt is faulty (or not).</li> <li>There is a fixed number (50) of bolts.</li> <li>A random sample.</li> </ul>	<b>B2</b>	1.2 1.2	5th Understand the binomial distribution (and its notation) and its use as a model.
		<b>(2)</b>		
4b	Let $X$ represent the number of faulty bolts. $X \sim B(50, 0.25)$ $P(X \leq 6) = 0.0194$ $P(X \leq 7) = 0.0453$ $P(X \geq 19) = 0.0287$ $P(X \geq 20) = 0.0139$	<b>M1</b> <b>M1dep</b>	3.4 1.1b	5th Find critical values and critical regions for a binomial distribution.
	Critical Region is $X \leq 6 \cup X \geq 20$	<b>A2</b>	1.1b 1.1b	
		<b>(4)</b>		
				<b>(6 marks)</b>
<b>Notes</b>				
4a	Each comment must be in context for its mark.			

AS Practice Paper H (Statistics & Mechanics) mark scheme

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
5a	Makes an attempt to find the absolute value. For example, $\sqrt{(14)^2 + (22)^2}$ is seen.	M1	3.1b	4th Find the magnitude and direction of a vector quantity.
	Simplifies to $\sqrt{680}$	M1	1.1b	
	Finds speed = 26.07... (ms <sup>-1</sup> ) Accept awrt 26.1 (ms <sup>-1</sup> )	A1	1.1b	
		(3)		
5b	States that $\tan \theta = \frac{22}{14}$	M1	1.1b	4th Find the magnitude and direction of a vector quantity.
	Finds the value of $\theta$ , $\theta = 57.52...$	A1	1.1b	
	Demonstrates that the angle with the unit <b>j</b> vector is $90 - 57.52...$	M1	1.1b	
	Finds 32.47... (°) Accept awrt 32.5(°)	A1	1.1b	
		(4)		
5c	Ignore the value of friction between the hockey puck and the ice.	B1	3.4	3rd Understand assumptions common in mathematical modelling.
		(1)		
5d	$\frac{1.4 \text{ g}}{1 \text{ cm}^3} \times \frac{1 \text{ kg}}{1000 \text{ g}} \times \frac{100 \text{ cm}}{1 \text{ m}} \times \frac{100 \text{ cm}}{1 \text{ m}} \times \frac{100 \text{ cm}}{1 \text{ m}}$ Award 1 method mark for division by 1000 and 1 method mark for multiplication by 100 only once and the final method mark for multiplication by 100 three times.	M3	1.1b	4th Know derived quantities and SI units.
	1400 kg m <sup>-3</sup>	A1	1.1b	
		(4)		
<b>(12 marks)</b>				
<b>Notes</b>				
5b	Award all 4 marks for a correct final answer. Award 2 marks for a student stating $\tan \theta = \frac{14}{22}$ , and then either making a mistake with the inverse or subtracting that answer from 90.			

AS Practice Paper H (Statistics & Mechanics) mark scheme

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
6	Makes an attempt to integrate $a = \frac{1}{500}(20t^2 - t^3)$ Raising power by one would constitute an attempt.	M1	3.1b	6th Uses differentiation to solve problems in kinematics.
	Correctly finds $v = \frac{1}{500}\left(\frac{20}{3}t^3 - \frac{1}{4}t^4\right)$ . Note that $C = 0$ .	A1	1.1b	
	Makes an attempt to integrate $v = \frac{1}{500}\left(\frac{20}{3}t^3 - \frac{1}{4}t^4\right)$ . Raising power by one would constitute an attempt.	M1	3.1b	
	Correctly finds $s = \frac{1}{500}\left(\frac{20}{12}t^4 - \frac{1}{20}t^5\right)$ . Note that $C = 0$ .	A1	1.1b	
	Substitutes $t = 10$ into $s = \frac{1}{500}\left(\frac{20}{12}t^4 - \frac{1}{20}t^5\right)$ to obtain $s = \frac{70}{3}$ (m). Accept awrt 23.3 (m).	A1 ft	1.1b	
		(5)		
				(5 marks)
<b>Notes</b>				
6	Award the final accuracy mark for a correct substitution using their equation for displacement.			

AS Practice Paper H (Statistics & Mechanics) mark scheme

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
7a	Makes an attempt to substitute $t = 25$ into $s = 30t - 0.4t^2$ . For example $s = 30(25) - 0.4(25)^2$ is seen.	M1	1.1b	5th Use equations of motion to solve problems in unfamiliar contexts.
	Correctly states that $AB = 500$ (m). Accept $s = 500$ (m).	A1	1.1b	
		(2)		
7b	Differentiates $s = 30t - 0.4t^2$ to obtain $v = 30 - 0.8t$	M1	3.1b	6th Solve problems using calculus and the equations of motion.
	Differentiates $v = 30 - 0.8t$ to obtain $a = -0.8$	M1	3.1b	
	States that $a = -0.8$ ( $\text{m s}^{-2}$ ) is a constant as it does not depend on $t$ .	A1	3.5a	
		(3)		
7c	States distance of the car from point $A$ is $s_1 = 30t - 0.4t^2$	M1	3.3	6th Solve problems using calculus and the equations of motion.
	$u = 2$ and $a = 0.1$ and an attempt to use $s = ut + \frac{1}{2}at^2$ is seen.	M1	3.3	
	States distance of the runner from point $B$ is $s_2 = 2t + 0.05t^2$	M1	1.1b	
	States that the runner and the car will pass each other when their distances total 500 (m), or writes $s_1 + s_2 = 500$ (m) or writes $30t - 0.4t^2 + 2t + 0.05t^2 = 500$	M1	3.3	
	States that $0.35t^2 - 32t + 500 = 0$ or equivalent.	A1	1.1b	
	Solves to find $t = 20$ (s). Answer does not need to state that $t = \frac{500}{7}$ or 71.4... (s) is not in the given range.	A1	1.1b	
	Makes an attempt to substitute $t = 20$ into $s_1 = 30t - 0.4t^2$ or $s_2 = 2t + 0.05t^2$ .	M1	1.1b	
	Correctly states they will pass each other 440 (m) from $A$ or 60 (m) from $B$ .	A1 ft	3.5a	
		(8)		
				(13 marks)
Notes				